system including a pupil defining unit disposed within the projection optical system so as to define a pupil of the projection optical system;

wherein the pupil defining unit comprises a variable aperture stop.

53 ~~87~~. (Twice Amended) A projection exposure apparatus comprising:

an illumination optical system in which an internal reflection type integrator is disposed on an optical axis to illuminate a mask with light from a light source passing through the internal reflection type integrator; and

a projection optical system, disposed in an optical path between the mask and a substrate, through which light from the mask passes, the projection optical system including a pupil defining unit disposed within the projection optical system so as to define a pupil of the projection optical system;

said illumination optical system including an optical device disposed on the optical axis to form a light intensity distribution having a substantially annular shape on a pupil plane of the illumination optical system, the optical device being capable of changing at least one of the annular ratio, the outer diameter, and the inner diameter of the light intensity distribution in accordance with a pattern on the mask.

64 ~~104~~. (Amended) An apparatus according to claim 63 ~~142~~, further comprising:

an optical integrator disposed in an optical path between said optical system and the mask, said optical integrator including a fly-eye type integrator or an internal reflection type integrator.

65 ~~105~~. (Amended) An apparatus according to claim 63 ~~142~~, further comprising a pupil changing unit disposed within said projection optical system so as to define a pupil of said projection optical system and change a numerical aperture of said projection optical system.

75 ~~113~~. (Amended) A projection exposure apparatus comprising:

an illumination optical system disposed in an optical path of light emitted by a light source so as to illuminate a mask, said illumination optical system including an optical

system disposed in an optical path between the light source and the mask so as to form a variable annular illumination source, said optical system changing an annular ratio with respect to the annular illumination source; and

a projection optical system disposed in an optical path between the mask and a substrate so as to project an image of the mask onto the substrate, said projection optical system including a pupil defining unit disposed within said projection optical system so as to define a pupil of said projection optical system;

said projection exposure apparatus satisfying the following condition:

$0.45 \leq NA_2/NA_1$

wherein NA_1 is a numerical aperture of said projection optical system, and NA_2 is a numerical aperture of said illumination optical system determined by the outer diameter of said variable annular illumination source.

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40 ~~122~~. (Amended) An apparatus according to claim ~~28~~ 39, wherein said projection optical system has a numerical aperture not less than 0.4 at a side of the substrate.

42 ~~123~~. (Amended) An apparatus according to claim ~~133~~ 41, wherein said optical system comprises an optical integrator and an aperture stop unit disposed in an optical path between said optical integrator and the mask, the aperture stop unit includes a circular opening and an annular opening so as to selectively form one of a circular illumination source and the annular illumination source.

~~124~~ 44. (Amended) An apparatus according to claim ~~133~~ 41, wherein said optical system changes the annular ratio with respect to the annular illumination source under a high illumination efficiency.

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49 ~~127~~. (Amended) An apparatus according to claim ~~135~~ 48, wherein said optical system comprises an optical integrator and an aperture stop disposed in an optical path between the optical integrator and the mask, the aperture stop unit includes a circular opening and an

annular opening so as to selectively form one of the circular secondary light source and the annular secondary light source.

50 ~~128~~. (Amended) An apparatus according to claim ~~125~~ 48, wherein said optical system comprises a first optical element with a first conical surface that is disposed in an optical path between the light source and the mask, a second optical element with a second conical surface that is disposed in the optical path between said first optical element and the mask, and a variable distance between said first optical element and said second optical element so as to change the annular ratio with respect to the annular secondary light source.

Please add the following claims 133-145:

41 ~~133~~. (New) An apparatus according to claim ~~28~~ 39, wherein said illumination optical system satisfies the following condition:

$$1/3 \leq d_1/d_2$$

wherein d_1 is the inner diameter of the annular secondary light source and d_2 is the outer diameter of the annular secondary light source.--

42 ~~134~~. (New) An apparatus according to claim ~~133~~ 41, wherein said projection exposure apparatus satisfies the following condition:

$$0.45 \leq NA_2/NA_1$$

wherein NA_1 is a numerical aperture of said projection optical system, and NA_2 is a numerical aperture of said illumination optical system determined by the outer diameter of said variable annular illumination source.--

48 ~~135~~. (New) An apparatus according to claim ~~29~~ 47, wherein said projection exposure apparatus satisfies the following condition:

$$0.45 \leq NA_2/NA_1$$

wherein NA_1 is a numerical aperture of said projection optical system, and NA_2 is a numerical aperture of said illumination optical system determined by the outer diameter of said variable annular illumination source.--

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--~~126.~~ (New) An apparatus according to claim ~~125~~, wherein said illumination optical system satisfies the following condition:

$1/3 \leq d_1/d_2$

wherein d_1 is the inner diameter of the annular secondary light source and d_2 is the outer diameter of the annular secondary light source.--

52 48

--~~127.~~ (New) An apparatus according to claim ~~125~~, wherein said illumination optical system satisfies the following condition:

$1/3 \leq d_1/d_2$

wherein d_1 is the inner diameter of the annular secondary light source and d_2 is the outer diameter of the annular secondary light source.--

Cont'd

58 53

--~~128.~~ (New) An apparatus according to claim ~~97~~, wherein said illumination optical system satisfies the following condition:

$1/3 \leq d_1/d_2$

wherein d_1 is the inner diameter of the annular secondary light source and d_2 is the outer diameter of the annular secondary light source.--

59 58

--~~129.~~ (New) An apparatus according to claim ~~128~~, wherein said projection exposure apparatus satisfies the following condition:

$0.45 \leq NA_2/NA_1$

wherein NA_1 is a numerical aperture of said projection optical system, and NA_2 is a numerical aperture of said illumination optical system determined by the outer diameter of said variable annular illumination source.--

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--~~130.~~ (New) An apparatus according to claim ~~128~~, wherein said optical device comprises a first optical element with a first conical surface, a second optical element with a second conical surface and a variable distance between said first optical element and said second optical element so as to change the annular ratio.--

61 60

--141. (New) An apparatus according to claim 140, wherein said projection exposure apparatus satisfies the following condition:

$$0.45 \leq NA_2/NA_1$$

wherein NA_1 is a numerical aperture of said projection optical system, and NA_2 is a numerical aperture of said illumination optical system determined by the outer diameter of said variable annular illumination source.--

62

63 --142. (New) An apparatus according to claim 103, wherein said projection exposure apparatus satisfies the following condition:

$$0.45 \leq NA_2/NA_1$$

wherein NA_1 is a numerical aperture of said projection optical system, and NA_2 is a numerical aperture of said illumination optical system determined by the outer diameter of said variable annular illumination source.--

65

73 --143. (New) An apparatus according to claim 105, wherein said pupil defining unit comprises an aperture stop unit changing the pupil of said projection optical system.--

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74 --144. (New) An apparatus according to claim 143, wherein said aperture stop unit comprises a variable aperture stop.--

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82 --145. (New) An apparatus according to claim 113, wherein said illumination optical system satisfies the following condition:

$$1/3 \leq d_1/d_2$$

wherein d_1 is the inner diameter of the annular secondary light source and d_2 is the outer diameter of the annular secondary light source.--

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REMARKS

Claims 1-29, 91-119 and 122-145 are pending. By this Amendment, claims 133-145 are added, claims 120 and 121 are canceled, and claims 28, 97, 104, 105, 113, 122-124, 127 and 128 are amended. No new matter is added by the above amendments.